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## Operation Plumbbob

Roger A. Meade

On June 24, 1957, a thirty-seven kiloton nuclear device, codenamed Priscilla, exploded 700 feet over the Nevada Test Site's Frenchman dry lake. Below, on the lakebed, was a bank vault designed by the Mosler Safe Company for one of several Federal Civil Defense Administration experiments. The vault was constructed "to evaluate the effectiveness of a reinforced-concrete vault and steel vault door in providing protection against the effects of a nuclear detonation." Blast damage to the exterior was largely confined to the side walls, whose concrete was stripped off; its steel reinforcing rods bent and twisted. The vault door was essentially undamaged and was opened with minimal difficulty. The vault contents - sandbags, movie camera, and thermometers - were only slightly disturbed. The camera operated as planned, running 40 ft of film. The film, however, was completely fogged. Two clinical type thermometers registered 88°F, and a 24-hr stylus American temperature recorder registered a constant 88°F.<sup>1</sup>

Priscilla was the fifth of twenty-nine tests conducted in 1957 as part of Operation Plumbbob, whose stated purpose was to conduct tests "aimed to attain new knowledge important to the defense of the United States and the Free World." Individual events included "proof tests of air defense and antisubmarine warheads to be stockpiled, development tests of bomb components and mockups, and design tests of smaller and lighter warheads." One test, John, was that of an air-to-air missile detonated 18,500 feet over the test site.<sup>2</sup>

Planning for Plumbbob, originally named Pilgrim, began in 1956 amid concerns about the cumulative effects of <sup>90</sup>Sr fallout, particularly on children, and a growing presidential desire to end testing. Although the fallout data, collected as part of Project Sunshine, was judged indeterminate, it remained a primary concern throughout the test series. Politically, President Eisenhower had reservations about conducting Plumbbob, both because of his interest in stopping testing and because of an ongoing international disarmament debate. Despite these concerns, the test series began on May 28th, with the firing of Boltzmann.

Many tower heights, beginning with Boltzmann, were increased to 500 feet to reduce soil uptake. However, there was a height limit, reached by the 700 foot Smoky tower, beyond which the stress loads could not be supported. Giant balloons, capable of lifting test devices to high altitudes, provided a cost-effective method of increasing heights of burst to over 1000 feet. Replacing towers also had the benefit of eliminating tons of steel from fallout. The successful containment of Rainer was a harbinger of the future, leading to the underground test regime bought about by the Limited Test Ban Treaty.<sup>3</sup>

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<sup>1</sup> Meade, Roger A. *Mosler versus the Atom: How Safe is a Safe*. LA-UR-19-32566; and Nevada Test Organization. *Background Information on Nevada Nuclear Tests*, Las Vegas, 1957: 70.; and *Project 30.4: Response of Protective Vaults to Blast Loading*, Operation Plumbbob, ITR-1451, 1957, 9.

<sup>2</sup> Hacker, Barton C. *Elements of Controversy: The Atomic Energy Commission and Radiation Safety in Nuclear Testing, 1947-1979*; 188; and *Background Information*, 39.

<sup>3</sup> Hacker, 188; and *Background Information*, 43.

In addition to the bank vault, another unlikely structure made its appearance during Plumbbob – a gun turret from the United States heavy cruiser Louisville. The turret, damaged during a kamikaze attack, was used to conduct line-of-sight experiments on the Diablo, Whitney, and Shasta events. “The turret was installed in Area 2 next to the 2-330 recording bunker. The left and right ports of the gun slide were sealed, and the central position was fitted with a 15.7’ long, 32” wide steel tube with a 6” lead-lined collimator running down the middle. With the ability to elevate 41degrees and to rotate through 360 degrees, the turret could observe all the devices of interest. It worked as predicted but was never used again because of the 1958 test moratorium and the subsequent ban on atmospheric testing.<sup>4</sup>

Plumbbob also included Operations Desert Rock VII and VIII, whose exercises were conducted primarily on the Priscilla, Hood, Smoky, and Galileo events. Priscilla’s primary objective was “to correlate the yield and characteristics of the device with its effects on military equipment, materiel, structures, and ordnance. Three hundred AFSWP personnel conducted thirty four scientific projects, making this event one of the largest military effects tests ever conducted at the NTS.”

Shot Hood, fired from a balloon suspended 1500 feet over Yucca Flat and the highest yield device fired in the atmosphere at the test site, “included troop observer and indoctrination projects, radiological training projects, and technical service projects.” After Smoky and Galileo, Army and Marine troops participated in field trials, radiological training, and psychological testing.<sup>5</sup>

Plumbbob also included five safety tests, “experiments designed to confirm that a nuclear explosion would not occur in case of an accidental detonation of the chemical explosive associated with the device.”<sup>6</sup> Four of these tests - Coulomb A and B as well as Pascal A and B - were detonated at or near the surface. One, Saturn, was detonated in a tunnel.

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<sup>4</sup> LLNL-JRNL-724417. *The Mystery of the Gun Turret in the Desert*. R. D. Hoffman, J. R. Leslie., February 17, 2017

<sup>5</sup> Defense Threat Reduction Agency. *Fact Sheet: Operation Plumbbob*. Fort Belvoir, Virginia, September 2021; and Hacker, 191-192.

<sup>6</sup> DOE/NV -- 209 – Rev 16. United States Nuclear Tests: July 1945 through September 1992. September 2015., 182.

## Operation Plumbbob<sup>7</sup>

<b>Shot</b>	<b>Sponsor</b>	<b>Date</b>	<b>Venue</b>	<b>HOB (ft)</b>	<b>Yield (kt)</b>
Boltzmann	LANL	05/28/1957	Tower	500	12
Franklin	LANL	06/02/1957	Tower	300	0.14
Lassen	LLNL	06/05/1957	Balloon	500	0.0005
Wilson	LLNL	06/18/1957	Balloon	500	10
Priscilla	LANL/DoD	06/24/1957	Balloon	700	37
Coulomb -A	LANL	07/01/1957	Surface	0	0
Hood	LLNL	07/05/1957	Balloon	1500	74
Diablo	LLNL	07/15/1957	Tower	500	17
John	LANL/DoD	07/19/1957	Air-to-Air	18,500	~2
Kepler	LANL	07/24/1957	Tower	500	10
Owens	LLNL	07/25/1957	Balloon	500	9.7
Pascal -A	LANL	07/26/1957	Shaft	-500	Slight
Stokes	LANL	08/07/1957	Balloon	1500	19
Saturn	LLNL	08/10/1957	Tunnel	-100	0
Shasta	LLNL	08/18/1957	Tower	500	17
Doppler	LANL	08/23/1957	Balloon	1500	11
Pascal -B	LANL	08/27/1957	Shaft	-500	Slight
Franklin Prime	LANL	08/30/1957	Balloon	750	4.7
Smoky	LLNL	08/30/1957	Tower	700	44
Galileo	LANL	09/02/1957	Tower	500	11
Wheeler	LLNL	09/06/1957	Balloon	500	0.1975
Coulomb - B	LANL	09/06/1957	Surface	0	0.3
LaPlace	LANL	09/08/1957	Balloon	750	1
Fizeau	LANL	09/14/1957	Tower	500	11
Newton	LANL	09/16/1957	Balloon	1500	12
Rainier	LLNL	09/19/1957	Tunnel	-880	1.7
Whitney	LLNL	09/23/1957	Tower	500	19
Charleston	LLNL	09/28/1957	Balloon	1500	12
Morgan	LLNL	10/07/1957	Balloon	500	8

<sup>7</sup> Derived from DOE/NV-209, Rev. 15.